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CURRANT-GRAPE GROWING: A PROMISING NEW INDUSTRY.

By GEORGE C. HUSMANN,

Pomologist in Charge of Viticultural Investigations, Office of Horticultural and Pomological Investigations.

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HISTORICAL INTRODUCTION.

Very few vines of the "Corinth grapes," from which the dried currants of commerce are made, have been grown in this country, and these in California only. Many people doubtless suppose that the fruit, which is sold as dried currants and extensively used in cakes, puddings, and the like, is grown on currant bushes.[1] Botanically the varieties of currant grapes belong to *Vitis vinifera*. According to Eisen, they are referred to by Pliny as grown in Greece in 75 A. D., no further historical record of them appearing for nearly a thousand years.

During the eleventh century, in the old herbals and in the literature of the fourteenth, fifteenth, and sixteenth centuries, references to them occur as "reysyns de corauntzs," "Corauntz," "Corent," "reysonys of Corawnce," "raysns of Coren," and "currans."

[1] *Ribes* sp.

The name "currant" has developed by gradual evolution from the name Corinth, the port whence the early supplies of this fruit reached western Europe. It is quite likely that the name "currant" was applied to the genus Ribes because of the resemblance its racemes of fruit bear to clusters of the "grape of Corinth."

Currant grapes are most extensively grown about Morea, the ancient Peloponnesus of Greece, and on the islands belonging to that country, including Cephalonia, Zante, and other adjacent islands. Of late years currant grapes have also been grown to some extent in Australia.

IMPORTANCE OF THE CURRANT INDUSTRY IN GREECE.

The devastation of the vineyards of France by the root louse[1] caused in that country a heavy demand, at high prices, for dried currant grapes to be used in the manufacture of wine and brandy. This resulted in the planting of such large acreages in Greece that in some regions the growing of these grapes became the sole industry.

The reestablishing of the French vineyards on phylloxera-resistant grape stocks introduced from the United States of America and the fact that France in 1883–84 imposed import taxes on dried currants practically excluded the Greek product from that country. This resulted in a crisis in the currant industry of Greece, as the production greatly exceeded the demand.

The "parakratesis," or "retention," act was passed by the Greek Parliament in 1895 for the purpose of maintaining prices and controlling the yearly output and to prevent as far as possible the overstocking of the markets. By its provisions every shipper of currants was obliged to deliver to the customhouse, together with his declaration of export, a receipt which showed that he had deposited in one of the Greek Government warehouses a quantity of currants equal, for example, to 15 per cent of those he desired to export. The exporter put on the bill which he forwarded to the purchaser a statement of the quantity ordered and its price, plus the price of the percentage of the whole order which he had deposited in the Government warehouse. Therefore, the foreign purchaser when buying 100 tons of currants paid the shipper for 115 tons and virtually made, through the exporter, a present of 15 tons to the Greek Government. The retention requirement was not always 15 per cent, but a figure decided upon yearly by a committee of officials from the different centers of currant production. The fruit thus donated by foreign buyers was sold by the Government to local distilleries and wine makers, with the proviso that it must not be exported as currants.

While the grower usually sold all his fruit direct to the shipper, he often preferred to deliver his inferior grades to the retention

[1] *Phylloxera vastatrix.*

warehouse, for which he received a receipt, which in Greece was negotiable and brought nearly as much as the market value of the currants.

The retained currants enabled the Government of Greece to promote the making of wines and brandies. With the money received for such currants a bank was established in 1899, called "The Currant Bank," with a capital of 3,500,000 drachmas (about $675,000). This bank lent money on easy terms to the growers of currant grapes on the security of their crop and assisted them in other ways.

The "parakratesis" act in this way directly levies a tax upon the foreign consumer and utilizes the surplus crop; but such a law will be of avail only so long as Greece has a monopoly in currants.

About 150,000 acres are devoted to currant-grape growing in Greece, which area in a favorable season produces from 300,000,000 to 340,000,000 pounds of currants.

IMPORTS OF CURRANTS INTO THE UNITED STATES.

The imports of currants into the United States from 1906 to 1918, inclusive, and their value are shown in Table I.

TABLE I.—*Quantity and value of currants imported into the United States for the 13-year period from 1906 to 1918, inclusive.*

Year	Pounds.	Value.		Year.	Pounds.	Value.	
		Total.	Per pound.[1]			Total.	Per pound.[1]
1906	37,078,311	$1,119,146	$0.030	1913	20,843,735	$1,306,410	$0.042
1907	38,392,779	1,746,941	.046	1914	32,033,177	1,233,228	.040
1908	38,652,656	1,592,018	.041	1915	30,350,527	1,209,273	.039
1909	37,482,111	1,185,106	.036	1916	25,373,029	1,382,839	.054
1910	33,326,030	1,190,020	.036	1917	10,476,534	1,056,525	.100
1911	33,439,565	1,486,263	.044	1918	5,168,070	561,904	.109
1912	33,151,396	1,561,350	.047				

[1] The part of the cents shown is the nearest decimal fraction.

From Table I it appears that the United States in the decade previous to the war annually imported nearly 34,000,000 pounds of dried currants, these at an average of 4 cents per pound, costing about $1,360,000. In 1917 the imports were 10,476,534 pounds, costing slightly more than 10 cents per pound, or $1,056,525; but in 1918, because no more were to be had, only 5,168,070 pounds were imported, costing almost 11 cents per pound, or $561,904.

EXPLORER'S NOTES ON CURRANT GRAPES.

The following extract from a letter dated March 6, 1901, of David Fairchild, Agricultural Explorer for the United States Department of Agriculture, transmitted with an introduction of Panariti cuttings from Greece, is of interest in this connection:

It is the custom in Greece to plant very long cuttings [see Pl. I, fig. 2] in the rocky soil, digging down even into the bedrock, upon which the base of the cutting is allowed to rest. In Greece the vines are about 5 feet apart each way and are trained wholly without a wire or other trellis. [See Pl. I, figs. 1 and 2.] The claim is made that the fruit is so delicate, being, as is well known, an essentially seedless grape, that it requires the dense shade made by the foliage of the low sprawling canes which spring from the low-cut upright main trunk of the plant. As the clusters mature [Pl. I, fig. 4] these sprawling canes are lifted from the ground and supported on short stakes to prevent the grapes from actually lying on the ground.[1] After the petals have dropped from the flowers—i. e., when the fruit is well "set"—the vines are ringed or girdled. This girdling is done on the main trunk of the vine, a thin quarter-inch wide ring of bark being removed [Pl. I, fig. 3]. This ringing is said to be essential to the production of a large berry. It is the belief that the berries from vines not ringed are richer in sugar, not so filled with juices, and keep better than those from ringed vines [Pl. I, fig. 3]. The climate and soil in which the corinth will thrive are various. The requisites are a long summer with good insulation and a not too high temperature, 95° F. being looked on as a very high temperature in the regions where these plants are cultivated. It is a popular belief that the corinth degenerates rapidly on being introduced into foreign countries and that it even becomes a seed-bearing grape. I can not find that this belief is supported by sufficient evidence. Samples of corinths grown in Australia show that at least the plant does not produce seed there and does produce a utilizable product, which, however, is inferior in size and flavor to good Greece-grown specimens.[2]

CURRANT-GRAPE VARIETIES.

In Greece, where the great bulk of the currants of the world are produced, commercial crop differences are not distinguished by varieties. However, three distinct colors, white, rose, and dark, therefore three varieties, are represented.

The Black Corinth variety (synonyms, *Zante currant*, *Passerina nera*, *Corinthe noir*, *Corinthe sans pipins*, *Corinthe violet*, *Corinthien*, *Corinto nero*, *Corinthe rosso*) was among the earliest grape introductions into California. Vine very vigorous. Bunches below medium in size, compact and cylindrical with well-marked shoulders, often winged. The berries are very small, not over three-sixteenths of an inch in diameter, reddish black, round, usually seedless.

The White Corinth variety (Pl. II; synonyms, *Corinthe blanc*, *Corinto blanco*, *Corinto bianco*, *Weisse Corinthe*, *Korinthe Kleine Weisse*, *Passeretta bianca*, *Passerina bianca*, *Passera*, *Coree blanc*, *Corinthari*, *Corinthi Apro Szemufeher*), is not quite so vigorous as the Black Corinth and has leaves lighter in color, otherwise resembling it very much. Clusters larger, more conical, and more compact; berries round, white, larger, and not of as good quality; neither do they make as good a dried product as the Black Corinth.

[1] This would appear to be essentially the Chantres system of training, practiced extensively in France, especially with varieties producing the Sauterne wines.

[2] See U. S. Dept. Agr., Bur. Plant Indus. Bul. 66, p. 84.

FIG. 1.—GRECIAN GRAPE GATHERERS.

FIG. 2.—A GRECIAN VINE DRESSER.

FIG. 3.—A PRUNED VINE, PANARITI, GREECE.

FIG. 4.—THE CHANTRES SYSTEM OF TRAINING.

A COMPARISON OF CURRANT-GRAPE CLUSTERS: *A*, PANARITI; *B*, WHITE CORINTH; *C*, RED CORINTH.

No trouble is experienced in making this variety bear good annual crops if accorded the same treatment that is given the Sultanina or Thompson Seedless. This probably accounts for its being grown in other than the currant-growing countries, while there is little or no such evidence with respect to the other varieties.

The vine and fruit of the Red Corinth variety (Pl. II, C; synonyms, *Corinthe rose*, *Corinthe rouge*, *Coristano rouge*) are very similar to those of the Black Corinth; the fruit, however, is lighter and rosier in color.

There appears to be no particular difficulty in successfully fruiting the white and rose-colored varieties, whereas no one in this country has been able to grow paying crops of the dark-colored grapes, which are of far superior quality either fresh or dried. This is no doubt largely due to the introduction of very poor strains, all of those that have come under the observation of the writer being inferior and worthless.

INTRODUCTION OF PANARITI CUTTINGS.[1]

An introduction of Panariti cuttings (S. P. I. No. 6429) made by the United States Department of Agriculture through David Fairchild, its agricultural explorer, reached Washington, D. C., on May 9, 1901. Mr. Fairchild stated that this was "the variety of grapes producing the currants, or corinths, of commerce. These cuttings were purchased in the village of Panariti, which lies among the mountains back of Xyloncastron. The village is noted for producing some of the finest corinths in Greece." In Greece crop differences are not distinguished by varietal names, but by the name of the region in which they are produced; thus Panariti grapes are those grown in the vicinity of the village of Panariti.

The above-mentioned Panariti cuttings arrived in Washington on the very day the writer entered on his viticultural activities with the Department of Agriculture, and constituted the first lot of grape material entrusted to his care. They consisted of a medley of old and young wood of miscellaneous strength and lengths, which arrived in a somewhat dry condition. The 1-year-old wood was made into cuttings, and some of these cuttings were distributed among grape growers in California, Arizona, and southern Nevada. This dis-

[1] It may be of interest to state that some Panariti cuttings were used in an experiment to determine how long they could be immersed in hot water at different degrees of temperature without killing them, and yet kill any phylloxera or root lice that might be on them. Some of these immersed cuttings were afterward planted in the nursery in the usual manner and others made into single-eye cuttings, placed in sand in the greenhouse, and given bottom heat. The results showed that those immersed for 10 minutes in water brought to 127° F. (53° C.) were put into better condition than those immersed only 5 minutes at the same temperature. By immersing them 5 minutes at 133° F. (56° C.) the best results were obtained, whereas at 140° F. (60° C.) an immersion of only 5 minutes was not only injurious but largely fatal to the cuttings.

tribution accounts for the occasional older vines of the variety found in California.

Repeated unsuccessful attempts have been made to grow currant grapes in this country.

Vines of the Zante or Corinth currant were imported from France as early as 1854 by the Patent Office and distributed principally in the Middle and Western States. As the root louse[1] of the grapevine is an insect which is indigenous in the States east of the Rocky Mountains and as the currant grapes, like all varieties of the Vinifera species when they are not grafted on resistant stocks, can not resist the attack of this pest, they were probably soon killed by it.

On September 27, 1861, Col. Agostin Haraszthy, of Sonoma, Calif., imported the White and Red Corinth varieties from the Crimea.

Small plantings of currant grapes are found in different parts of California, and while a few growers have succeeded in getting fair crops of the White Corinth, no one appears to have been able to fruit successfully the superior dark-colored variety from which the currants of commerce are produced.

DESCRIPTION OF THE PANARITI GRAPE.

Because of the important part it is possible that the Panariti variety may have in the viticulture of this country the following rather detailed description of it is given:

Vine a vigorous, dense, slightly spreading grower. Young wood medium slender, round; internodes medium, long, thin; nodes slightly enlarged; buds prominent, pointed, starting early; pith large, discontinuous at diaphragm; tendrils intermittent, forked; canes light brown, striped, smooth; growing tips reddish and hairy. Leaf medium size, oblong, cordate, five lobed, margin serrate; petiolar sinuses deep, narrow, usually overlapping; upper leaf surface dark green with light-colored veins; lower surface lighter green, slightly pubescent; petiole medium slender, slightly enlarged at base.

Blossom entire, small, opens early, stamens upright, longer than pistil. Blooming period medium, blossoms abundant.

Cluster on ringed vines medium compact, cylindrical, medium length, narrow, prominently shouldered, often winged. Berries small, usually less than one-fourth of an inch in diameter, adhering well, globose, color grizzly to black, with light-colored bloom, surface smooth; skin thin, tender; flesh pearly white, soft, juicy, seedless. Flavor rich, characteristic, very high in sugar, from 28.5° to 32.2° Balling scale, and relatively high, from 0.6600 to 0.8725, in acid as tartaric (grams per 100 c. c.). Excellent in quality, both as a fresh fruit and dried. Ripens very early, from July 15 to August 15. (Pl. III.) Usually produces a very light second crop of small, round, straggling clusters of seeded berries, much larger but in quality inferior to those of the first crop.

Plate II, showing average clusters of the specially introduced Black Corinth variety from Panariti, Greece, and a cluster each of Red Corinth and White Corinth grapes, will serve better to bring

[1] *Phylloxera vastatrix.*

out the general difference between them. In such comparison, however, the description of the Panariti variety should be considered instead of that given of the Black Corinth.

CURRANT GRAPES SUCCESSFULLY GROWN IN THIS COUNTRY.

The viticultural investigations of the United States Department of Agriculture have demonstrated that the choicest varieties of these currant grapes, which formerly it was believed could not be made to bear sufficiently, can be made to produce regular and good crops. This paves the way for the establishment of another very important and extensive grape industry in this country.

An exceedingly important feature is that the currant grapes are among the very earliest to ripen; in fact, they ripen so early that they can be dried and put away before the earliest rains occur in districts where other raisin varieties are too late in ripening. In the present raisin sections of this country currants can be grown as an advance crop and cured and stored by the time other raisin grapes ripen, so that the same labor employed in harvesting and curing currant grapes can harvest and cure the other raisins after having accomplished that work.

Though exceptional difficulties were encountered in growing the choicer strains, the knotty parts of this problem have been solved. Two cardinal points must be observed in order to grow them successfully: They should be grafted on phylloxera-resistant stocks congenial to them and suited to the soil and other conditions in which they are grown, and the vines need to be thoroughly ringed at the proper time. (See Pls. IV and V.)

The experiments made by the United States Department of Agriculture at the Fresno Experiment Vineyard indicate that when vines of the currant grape are planted at distances the equivalent of 8 by 8 feet apart, as Vinifera vineyards usually are, an acre of good vineyard in this country will yield from 6 to 15 tons (an average of 10½ tons) of grapes, or, conservatively, from 2 to 5 tons of cured currants. From this it will be seen that 3,400 to 8,500 acres would be necessary in order to produce the 34,000,000 pounds which normally are annually imported, and no doubt the consumption could be very much increased beyond its present limits.

CONDITIONS SUITED TO CURRANT-GRAPE CULTURE.

All of the good vineyard soils in the Vinifera regions of the United States are probably suitable for currant-grape growing. The congeniality tests of Panariti grapes on phylloxera-resistant stocks, of which mention is made later, have demonstrated that this variety will do well on a sufficient number of stocks to permit a

selection of such as are well suited to the principal types of vineyard soil.

All the districts in California in which grapes for various purposes are now grown appear to have suitable conditions for the growing of currant grapes. The fruit of the same Vinifera varieties, when grown in some of the bay counties of California, is of finer quality than when grown in the San Joaquin Valley, and it is reasonable to suppose that the same may be true of the Panariti variety.

It is, of course, a great advantage in growing grapes for drying purposes to be in a district which permits sun drying. Protection against the dew at night will probably be necessary in some of the coast districts, but it is preferable that the currant grapes be shaded most of the time while drying and the same shelter can be made to answer both purposes.

ANALYSIS OF THE SOIL OF THE FRESNO EXPERIMENT VINEYARD.

Because most of the investigations of the currant grapes have been made at the Fresno Experiment Vineyard of the United States Department of Agriculture, 3 miles east of Fresno, Calif., the mechanical analysis of the soil of that locality, made by the Bureau of Soils of the United States Department of Agriculture, will be of interest. (Table II.)

TABLE II.—*Analysis of the soil of the Fresno Experiment Vineyard, near Fresno, Calif.*

Description and depth of soil.	Mechanical constituents (per cent).							
	Coarse gravel.	Fine gravel (2 to 1 mm.).	Coarse sand (1 to 0.5 mm.).	Medium sand (0.5 to 0.25 mm.).	Fine sand (0.25 to to 0.1 mm.).	Very fine sand (0.1 to 0.05 mm.).	Silt (0.05 to 0.005 mm.).	Clay (0.005 mm. and smaller).
Brown sandy loam:								
0 to 12 inches	0.58	1.2	9.8	6.7	18.4	12.0	32.3	19.7
12 to 24 inches	.71	.9	9.1	6.9	17.8	12.3	32.5	21.4
Sandy loam:								
24 to 36 inches	.51	.6	8.3	7.8	19.9	12.9	27.1	23.5
36 to 48 inches	.35	.9	8.8	6.0	13.7	13.1	36.3	21.4
Free sandy loam:								
48 to 60 inches	.11	1.2	14.2	8.6	22.4	15.7	26.5	11.1

Of this type of soil about 75,000 acres near Fresno, 6,000 acres near Stockton, and about 265,000 acres in the Sacramento Valley have been mapped by the Bureau of Soils. For further descriptions of these soils, see Bureau of Plant Industry Bulletin 172, entitled "Grape Investigations in the Vinifera Regions of the United States with Reference to Resistant Stocks, Direct Producers, and Viniferas," and the surveys of the Bureau of Soils.

CLUSTER OF PANARITI GRAPES.

The lines on the left margin indicate inches.

FIG. 1.—PANARITI (RINGED VINE) YIELDED 33 POUNDS OF GRAPES.

FIG. 2.—PANARITI (NOT RINGED) YIELDED 6½ POUNDS OF GRAPES.

COMPARISON OF TWO VINES OF THE PANARITI VARIETY.

These two vines, grafted on the same stock (Rupestris St. George), growing side by side, of the same age, and comparable in every way, received the same attention and care except that a ring of bark one-fourth of an inch wide was removed at blossoming time from the trunk (see arrow) of the vine shown in figure 1. Both vines were photographed at fruit-ripening time.

FIG. 1.—TRUNK OF VINE, SHOWING THE RINGING DONE ON MAY 23, 1917, WHEN THE VINE WAS IN BLOOM.

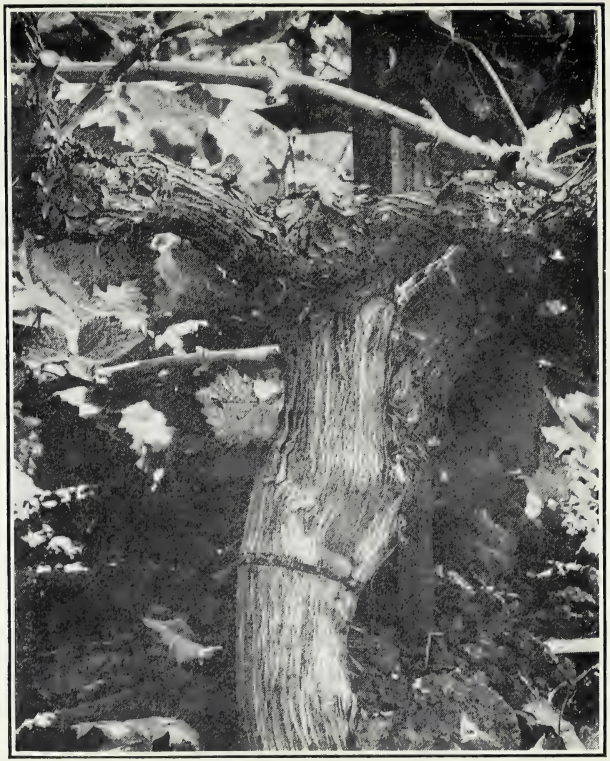

FIG. 2.—THE SAME VINE, SHOWING THE RINGING ON ITS TRUNK HEALED OVER, JULY 15, 1917, WHEN THE FRUIT WAS RIPE.

TWO VIEWS OF A PANARITI GRAPE VINE GRAFTED ON ARAMON × RUPESTRIS GANZIN NO. 1.

FIG. 1.—CROSS PLOWING A VINEYARD TRAINED TO STAKES.

FIG. 2.—A VINEYARD TRAINED TO STAKES READY FOR PLOWING.

FIG. 3.—A TRELLISED VINEYARD AFTER PLOWING.

PREPARATION OF THE SOIL, PLANTING, AND CULTURE OF CURRANT VINEYARDS.

When virgin soil is to be used, and even when the land has previously been in vineyard, it can be put in better shape if a crop of grain is grown on it the season before planting. After being plowed and subsoiled, the land should be thoroughly harrowed and the clods crushed with a drag or roller.

Since the currant grapes are true Viniferas, the usual practices in growing and caring for such grapes will apply to them. Some plant the vines 8 feet apart each way, others plant them 6 by 10, 9 by 9, 8 by 10, or even wider distances apart when stakes are used as supports. When trellises are used the vines are planted 12 by 6, 14 by 6, 14 by 8, or 16 by 8 feet apart. In the first plowing the soil is usually thrown away from the vines, and in the second plowing it is thrown up against them again. (Pl. VI, fig. 3.) When stakes only are used as supports the grower can plow and cultivate lengthwise and crosswise. (See Pl. VI, figs. 1 and 2.) In doing this the vineyards are plowed twice annually. The soil is kept level and more evenly worked up. If the first plowing is north and south, for example, the second should be east and west, while the next year the opposite course is pursued. Furthermore, the cultivation or harrowing given after each plowing is at right angles to the plowing and not parallel with it. (See Pl. VI, fig. 1.) In the Vinifera regions all plowing and culture is abandoned after the spring rains are over. Where irrigation is not necessary it should not be practiced.

PRUNING AND TRAINING THE VINES.

In our experiments with currant grapes a number of pruning and training methods have been tried. With simple stakes as a support, the following, among others, have been used: Spur, stools, or short pruning; long, or cane pruning (fig. 1); canes with laterals; and long canes bent over and tied as a circle (fig. 2). With trellises as a support, the following systems have been tested: Two-cane renewal, 4-cane renewal, fan system, high renewal, low renewal, Munson system, etc. The best all-around results with these grapes have been obtained by training them according to the long or cane pruning system. (Fig. 1.) For explanations and illustrations of the different pruning systems, see Farmers' Bulletin 471, entitled "Grape Propagation, Pruning, and Training." For Panariti vines in fruit trained in this way, see Plate IV, figures 1 and 2. The cheaper training systems, permitting cross culture of the vineyards, give good results with Panariti grapes, but since annual ringing is necessary in order to obtain full crops and since stakes would interfere

with the work of ringing, the vines need to be trained to carry themselves without support at the age of fruiting. If stool pruning to fairly high heads is not practicable and no better way is found, the same purpose may be accomplished by pruning so as to leave the canes long enough to permit bending and tying to form a self-supporting circle, as shown in figure 2.

Experiments are now being made to determine the methods of pruning, training, and culture necessary for the best results. It would be an easy matter, of course, to select a trellis system of training that would adapt itself to the growing of the currant-grape varieties if it should be determined that it is best to prune them long and train them to a trellis, as is recommended in California Experiment Station Bulletin 298, entitled "The Seedless Raisin Grapes."

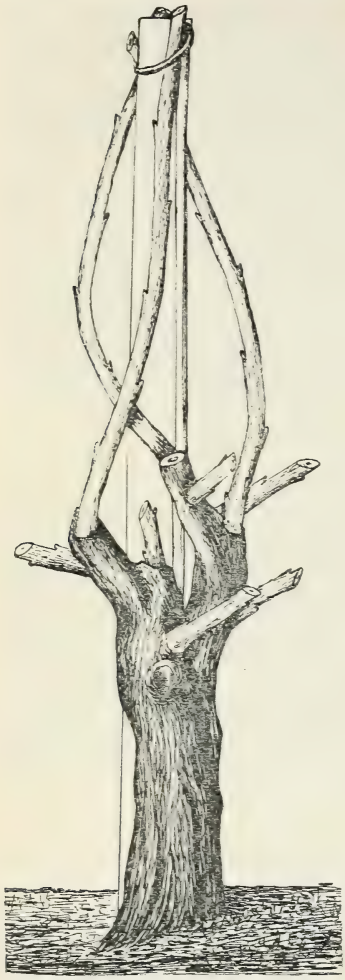

FIG. 1.—A grapevine pruned to canes.

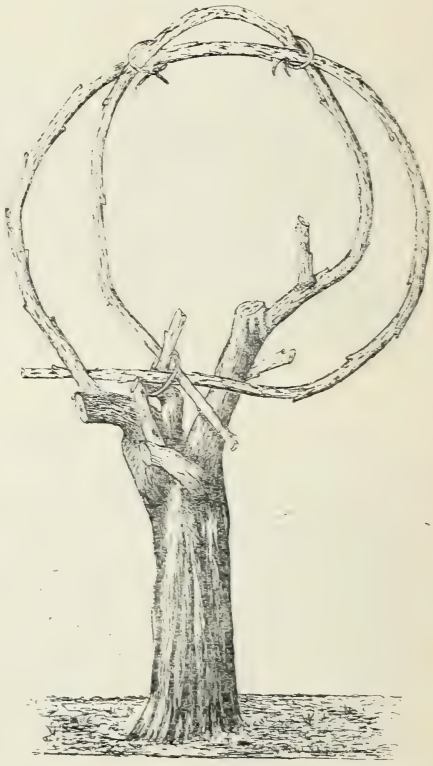

FIG. 2.—A grapevine pruned to long canes, the canes afterwards being bent in a circle as a support.

RINGING THE VINES.

It has been found that in order to make the blooms set and secure full yearly crops of grapes the vines must be ringed every year.

This ringing consists of making two parallel incisions through the bark and cambium layer around either the trunk, the arms, or the canes of the vines and completely taking out the bark and cambium layer between the two parallel incisions. (Pl. V, fig. 1.) This does not interfere with the upward flow of the sap through the outer ring of undisturbed wood, but where the ringing occurs checks the returning flow while the ringed place is healing. (Pl. V, fig. 2.) The effects of ringing are a full setting of fruit and much larger berries and clusters. (Pl. IV, figs. 1 and 2.) The ringing is done either with a large-bladed pocketknife or with special tools made for the purpose (fig. 3).

In ringing several factors need special consideration. The time the ringing is done is a most important matter and is related to the blooming period. If done either too early or too late, the desired results will not be obtained. It is best to do the ringing when the clusters are partially in bloom or in the middle of the blooming period. The blooming period being of relatively short duration (usually not more than 10 days), when ringing on an extensive scale it is advisable to start just as the first flowers open and continue ringing throughout the blooming period. The effects on fruit setting are noticeable with vines ringed after they stop blooming.

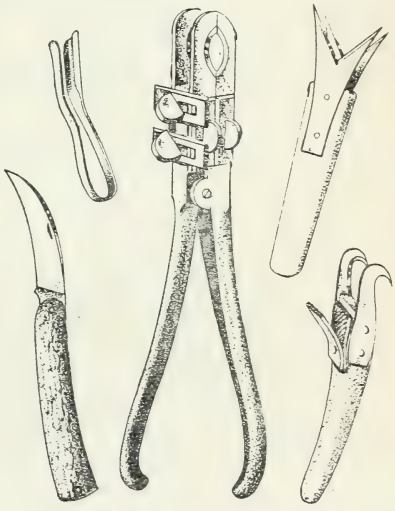

FIG. 3.—Some tools used in ringing vines.

The depth of the incisions is also very important. They should be made entirely through the cambium layer, and the matter between the two incisions should be immediately and completely removed. The results obtained will depend on the thoroughness of this part of the operation.

The width between the two parallel incisions is also an important matter. The distance between the incisions should be no wider than is absolutely necessary to allow a narrow circlet of the bark and cambium to be removed. On the arms and canes of vines a circlet one-eighth of an inch wide is sufficient; for large arms and trunks of vines a circlet one-fourth of an inch wide is necessary. If good judgment is used in doing this work the circlet removed on the vines ringed while in bloom should be completely healed over in six to eight weeks, or by the time the grapes are ripe.

Another important factor is the part of the vine to ring. The effects on the vine are manifest, of course, only beyond the place of

ringing. Hence, the entire vine is affected by one ringing of the trunk, but when either arms or canes are chosen all of them must be ringed, in order that the entire vine may be affected.

In the experiments conducted at the Fresno Experiment Vineyard, 12-year-old ringed Panariti grafts on 10 different resistant stocks trained to stakes (vines 8 by 8 feet apart, or 680 to the acre) during 1917 and 1918 gave average annual yields per acre ranging from about 5.8 tons (Pl. IV, fig. 1) on the poorest stock to 10.35 tons on the best stock, the average on all the stocks being nearly 7½ tons. The check vines with like treatment and care averaged only 2⅔ tons to the acre (Pl. IV, fig. 2). Ringed 5-year-old Panariti grafts on 18 different resistant stocks, with trellis training (vines 8 by 8 feet apart, or 680 to the acre) during 1917 and 1918 averaged annually over 5 tons to the acre, while the check vines averaged only 1.9 tons to the acre.[1]

CONGENIALITY OF THE PANARITI VARIETY TO PHYLLOXERA-RESISTANT STOCKS.

In the belief that an important new grape industry can be developed from the dried fruit of the Panariti grape, and that it is destined to play an important rôle in Vinifera viticulture, this variety was one of those selected for extensive tests of the congeniality of Vinifera grape varieties to the important phylloxera-resistant stocks at the Fresno Experiment Vineyard in California.

In a 10-year test of the Panariti variety grown on various resistant stocks, a sufficient number of varieties of these stocks have been found from which to select those which are adapted to any of the types of grape soil, as well as to other conditions which are congenial to the currant-grape varieties and on which they show a tendency to good fruiting.

The data given in Table III show the relative behavior of Panariti vines growing on 10 different phylloxera-resistant stocks in the Fresno Experiment Vineyard. Ten vines each of the Panariti grape grafted on the Lenoir, Rupestris St. George, Riparia Gloire, Salt Creek, and Dog Ridge were included in the tests. Of each group of 10 vines, 2 were check vines, 4 were vines with canes ringed, and 4 were vines with trunks ringed. Five vines each of Panariti variety grafted on the Adobe Giant, Aramon × Rupestris Ganzin No. 1, Mourvedre × Rupestris No. 1202, Riparia × Rupestris No. 3309, and Solonis × Riparia No. 1616 were also included in the tests. Of each group of five vines, one was a check vine, two were vines

[1] For further information on the adaptability of resistant stocks to soils and other conditions see Bureau of Plant Industry Bulletin 172, entitled "Grape Investigations in the Vinifera Regions of the United States with Reference to Resistant Stocks, Direct Producers, and Viniferas," and Department of Agriculture Bulletin 209, entitled "Testing Grape Varieties in the Vinifera Regions of the United States."

with canes ringed, and two were vines with trunks ringed. All these vines were trained to stakes.

TABLE III.—*Relative behavior of check vines and ringed vines of the Panariti variety of currant grapes grafted on 10 varieties of phylloxera-resistant stocks trained to stackes at the Fresno Experiment Vineyard of the Department of Agriculture in California for a period of 10 years, together with fruiting results in 1917 and 1918.*

Name of the variety and of the stock upon which it was grown.	Congeniality.	Range of dates in the 10-year period.		
		Growth starting.	Blooming.	Fruit ripening.
1	2	3	4	5
Panariti variety:				
Adobe giant	89	Mar. 2 to Mar. 28	May 2 to May 25	July 20 to Sept. 2.
Aramon × Rupestris Ganzin No. 1.	96	Mar. 1 to Apr. 1	May 6 to May 28	July 15 to Sept. 15.
Dog Ridge	93	Mar. 6 to Mar. 26	May 1 to May 22	July 15 to Sept. 10.
Lenoir	86	Mar. 2 to Mar. 27	May 1 to May 20	July 15 to Sept. 5.
Mourvedre × Rupestris No. 1202.	92	Mar. 4 to Apr. 1	May 5 to May 20	July 15 to Sept. 12.
Riparia Gloire	89	Mar. 4 to Mar. 26	May 2 to May 20	July 22 to Sept. 10.
Riparia × Rupestris No. 3309	95	Mar. 4 to Mar. 27	do	July 15 to Sept. 16.
Rupestris St. George	95	Mar. 5 to Mar. 27	May 2 to May 23	July 15 to Sept. 14.
Salt Creek	85	Mar. 1 to Mar. 26	May 1 to May 20	July 15 to Sept. 15.
Solonis × Riparia No. 1616	92	Mar. 5 to Mar. 28	May 2 to May 20	July 15 to Sept. 16.

Name of the variety and of the stock upon which it was grown.	Yield of fruit (pounds).				Sugar content (Balling scale).		Acid as tartaric (grams per 100 c. c.).	
	In 1917.		In 1918.					
	Check vines.	Ringed vines.	Check vines.	Ringed vines.	In 1917.	In 1918.	In 1917.	In 1918.
1	6	7	8	9	10	11	12	13
Panariti variety:								
Adobe Giant	7.5	27.25	7.5	30.5	30.5	27	0.9675	0.8770
Aramon × Rupestris Ganzin No. 1.	21	36.25	11	20.25	28	26	.7650	.8255
Dog Ridge	3	12	3	22.5	26.5	28	.8300	.8250
Lenoir	1.5	13.25	2	10.25	28	26	.6450	.7500
Mourvedre × Rupestris No. 1202	8	19.5	1.5	13.5	23.5	28	.8700	.7575
Riparia Gloire	5	10.5	2	7.75	23.5	30	.8850	.9450
Riparia × Rupestris No. 3309	17	30.25	20	28.5	28.5	26	.8650	.8250
Rupestris St. George	6.5	15.5	2	20.5	28.5	26	.7800	.8550
Salt Creek	8	19.25	1.5	15.5	28	26	.7800	.8175
Solonis × Riparia No. 1616	24.5	26.25	19	16	29	26	.6900	.8325
Average	10.2	21	6.95	18.525	27.4	26.9	.80775	.8310

The significance of the data in the various columns of Table III is made clear by the following explanation:

Column 1 shows the name of the variety and of the stocks upon which it was grafted.

Column 2 shows the congeniality existing between the resistant stock and the variety grown upon it, expressed in the form of a percentage rating on a scale in which the growth of the variety when not grafted but growing as an entire plant on its own roots, under conditions to which it is well adapted, is taken as the standard of excellence, 100 per cent. The congeniality percentages therefore represent the behavior of the Panariti variety when grafted on the several stocks in the Fresno Experiment Vineyard expressed in terms that permit com-

parison with its behavior when growing as an entire plant on its own roots. T illustrate, the table shows that as to congeniality the Panariti when grafted Aramon × Rupestris Ganzin No. 1 was rated at 96, when on Dog Ridge at and when on Salt Creek at 85. This shows that the Panariti variety, which well adapted to the conditions in the Fresno Experiment Vineyard, when graft on these stocks at the same time under the same conditions, with the sa treatment in the same vineyard, varied in growth and behavior in compari with the variety on its own roots in accordance with the above ratings.

Columns 3 and 4 show the earliest and the latest date of starting into growth and of blooming, respectively, on the 10 stocks during the 10 years. These data are given as a basis of comparison with other grape varieties growing in the same locality. As the vines must be ringed while they are blooming, the blossoming data also indicate the time of year when the ringing must be done.

Column 5 shows the earliest and the latest date of fruit ripening on the stocks during the 10 years. This serves to show that currant grapes can be grown in advance of other raisin grapes and that they may be sun dried before the fall rains start in districts where other raisin grapes ripen too late.

Columns 6 and 7, respectively, show the yield of fruit per vine that the Panariti check vines bore in 1917 on each of the 10 stocks, compared with the yield of fruit per vine borne by ringed Panariti vines on the same stocks growing side by side, with otherwise the same care and treatment given them the same year.

Columns 8 and 9, in like manner, afford a comparison of the yields of fruit in 1918.

Columns 10 and 11 compare the sugar content (Balling scale) of the fruit of the Panariti variety on each of the 10 stocks in the years 1917 and 1918, respectively.

Columns 12 and 13 compare the acid content (grams per 100 c. c.) of the fruit of the Panariti variety on each of the 10 stocks in the years 1917 and 1918, respectively.

Table IV shows the relative behavior of two young Panariti vines (ringed), each growing on 15 additional stocks, during a 4-year period, the vines being trained to a trellis. Explanations similar to those given for the same columns in Table III apply to columns 1 to 5 in Table IV. Columns 6 and 7 show the relative quality and yield of fruit of the Panariti vines on each of the 15 different resistant stocks.

The data in Table IV relating to the behavior of young Panariti vines trained to a trellis for only two vines each on 15 resistant-stock varieties do not allow a fair comparison with data in Table III of the behavior of older vines trained to stakes, but promises of larger yields with trellis training are indicated. More elaborate tests of these and other stocks are now under way to obtain more conclusive data as to congeniality.

The results of the ringing experiments for 1919 have not been compiled as yet. It is known, however, that they corroborate and strengthen the results obtained in 1917 and 1918, and that the actual yields in 1918 were fully 10 per cent heavier than those of 1917, when the heaviest crop that up to that time had been grown was obtained.

FIG. 1.—DRYING CURRANTS ON WOODEN TRAYS.

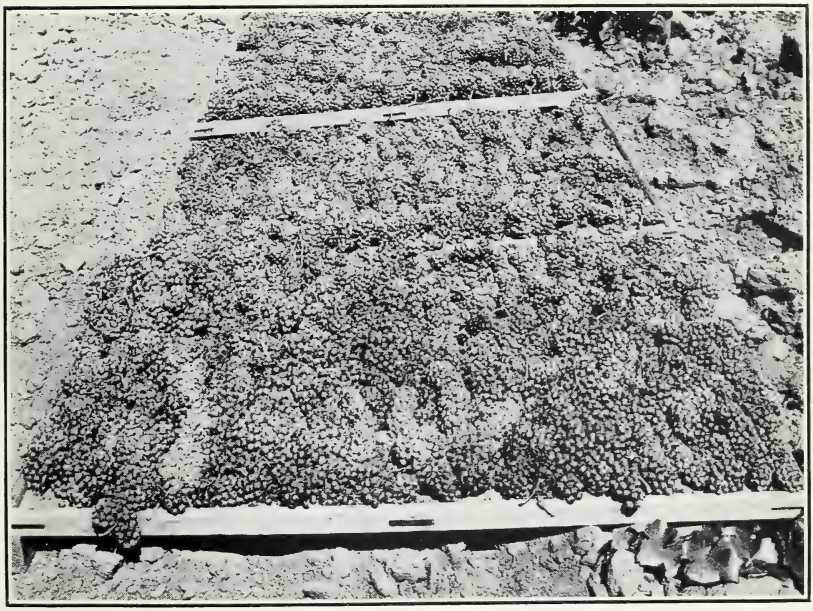

FIG. 2.—DRYING CURRANTS ON WIRE-SCREEN TRAYS.

TABLE IV.—*Relative behavior of ringed vines of the Panariti variety of currant grapes grafted on 15 varieties of phylloxera-resistant stocks, trained on a trellis at the Fresno Experiment Vineyard of the Department of Agriculture in California, showing the fruiting results in 1918.*

Name of the variety and of the stock upon which it was grown.	Congeniality.	Range of dates in 4-year period.			Fruit borne in 1918.	
		Growth starting.	Blooming.	Fruit ripening.	Quality.	Weight per vine (pounds).
1	2	3	4	5	6	7
Panariti variety:						
Aramon × Rupestris Ganzin No. 2	74	Mar. 12 to Mar. 30.	May 7 to May 14.	July 22 to July 25.	Very good	17
Berlandieri × Riparia No. 420–A	84	Mar. 12 to Mar. 26.	May 5 to May 8.	July 20 to July 22.	Excellent	25
Clairette dore' Ganzin	89	Mar. 12 to Mar. 25.	May 6 to May 9.	Aug. 2 to Aug. 9.	Very good	32.5
Constantia	86	Mar. 12 to Mar. 23.	May 6 to May 13.	July 25	do	12.5
Hotporup	65	Mar. 10 to Mar. 27.	do	July 22 to July 25.	Good	12.5
Monticola × Riparia No. 18804	88	Mar. 10 to Mar. 23.	May 5 to May 13.	July 19 to July 25.	Very good	13
Monticola × Riparia No. 18808	74	Mar. 10 to Mar. 24.	May 6 to May 17.	July 22 to July 25.	Good	23
Monticola × Rupestris	89	do	do	July 19 to July 25.	Very good	12.5
Riparia × Rupestris No. 3306	88	Mar. 12 to Mar. 28.	May 5 to May 15.	July 20 to July 25.	Excellent	12.5
Riparia × Rupestris No. 101–14	74	Mar. 12 to Mar. 26.	May 6 to May 19.	July 24 to July 25.	Very good	6
Rupestris Martin	76	Mar. 13 to Mar. 27.	May 5 to May 19.	Aug. 1 to Aug. 9.	do	13.5
Rupestris Mission	69	Mar. 13 to Mar. 25.	May 7 to May 19.	do	do	15.5
Rupestris × Berlandieri No. 219–A	81	Mar. 13 to Mar. 29.	May 6 to May 17.	July 25	do	13
Solonis Robusta	84	Mar. 9 to Mar. 23.	May 5 to May 17.	July 18 to July 25.	do	7.5
Viala	86	Mar. 11 to Mar. 24.	May 5 to May 18.	Aug. 1 to Aug. 9.	do	34

HARVESTING AND CURING CURRANTS.

DRYING AS FORMERLY PRACTICED IN GREECE.

The following is quoted from the Agricultural Explorer's notes under date of March 6, 1901:

The drying of the fruit is an important process, and there is one common substratum upon which all the corinths of commerce are dried. It is a sun-baked paste of cow manure. Whether a drying floor is prepared on open spots of ground scattered through the vineyards or consists of a large number of light wooden trays to be carried by the hand, makes no difference, both must be first painted with a thick coat of the above-mentioned paste and allowed to dry in the sun. The explanation given is that the dried paste absorbs the moisture from the injured grapes and continues during the night to absorb moisture, as a coating of blotting paper would. In addition to this important office as an absorbing stratum it is claimed that the fumes of ammonia which are given off by it have the effect of giving the berries the desired dark-blue color which is demanded by the trade. Whatever may be said in favor of this method of curing, it can not fail to strike the unacquainted as an exceedingly curious and objectionable one. A visit to the drying fields does not conduce to a removal of one's objection to such a method. Some improved clean substratum ought to take the place of this old one, even though it ruin the large manufactures of manure paste.

Since the date mentioned above, the methods of drying, curing, and marketing currants in Greece have apparently become more modern and sanitary.

DRYING AS PRACTICED AT FRESNO.

In the drying experiments with currant grapes made in the Fresno Experiment Vineyard by Mr. Elmer Snyder, scientific assistant, wire-screen trays and the ordinary wooden trays were used. The wire-screen trays allow slightly more uniform drying, but this is not important enough to justify the difference in the cost of the trays. (See Pl. VII, fig. 2.) A first-class entirely satisfactory product (in every way superior to imported currants) was obtained by using wooden trays. (See Pl. VII, fig. 1.) Because these grapes ripen so very early (Tables III and IV) there is practically no danger from rain at Fresno. The sun is very hot there at that time, and as the berries are very small, thin skinned, and high in sugar content little time is required to complete the drying process. The grapes should not be picked until they are fully ripe or, in the case of the Panariti variety, until they test from 28° to 32° Balling scale, varying with the season. The fruit as picked was placed on the trays, and it was found that it needed no turning, as it was exposed to the sun only a day or never longer than two days. The trays of drying grapes were then stacked one on top of another, with wooden strips between them to separate the trays, so that there was free circulation of air through them. Empty trays or some other covering were put on the top of the stack. An average of 15 days was required for the drying grapes to remain stacked before they were sufficiently cured to be transferred to the sweat boxes.

In drying experiments made during three seasons it has been found that when the Panariti grapes were picked at 26° Balling scale it took practically 3½ pounds of fresh fruit to make 1 pound of the dried product, while when picked at 30° to 32° Balling scale it required scarcely 3 pounds of fresh fruit to make 1 pound.

DRYING PRACTICE IN DRY-WINE SECTIONS.

In the dry-wine sections of California, where the Panariti variety will, in the average seasons, ripen sufficiently early to be dried out of doors without any interference from rain, the drying will need to be somewhat modified, because the sun usually is not so hot. The grapes when placed on the trays need to be exposed a greater number of days and the trays should be covered during the night to protect them from dew. After the partially dried grapes are stacked, the further procedure with them is like that previously described.

For fuller particulars as to raisin curing, consult United States Department of Agriculture Bulletin 349, "The Raisin Industry." Copies of this can be had by sending 10 cents, the price of the bulletin, to the Superintendent of Documents, Government Printing Office, Washington, D. C.

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